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The Significance of Adolescent Interests in Biology[1]

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To discuss the significance of adolescent interests in biology first implies that these interests exist. Of this there can be little doubt. In spite of superficial differences, best explained on the basis of different research techniques, with different groups of pupils, there still remains a clear indication of biological interests in the previous studies.[2] The recent research of the author[3] has gathered data from over 3,200 high school pupils in over 7,000 research contacts. Here six different techniques were used, providing a variety of ways in which interests might be expressed. The findings of the study cannot be repeated here in detail. Throughout there was a constant expression of interest in topics of a biological nature.

In a questionnaire filled out by 815 pupils was the question "What would you like to find out best in science?" 43% of the boys and 55% of the girls gave *specific* biological responses, the majority of which related to health, anatomy, physiology, and animal life. 1,161 pupils in English classes wrote compositions on the same question. These pupils were free from any suggestion which might come from the mere presence of a science teacher or from being in the science laboratory. Compositions also permitted a great freedom of response so that a total of 366 topics were mentioned. Of these 43% were biological. Interest in *specific* biological topics was expressed by 33% of the boys and 54% of the girls. Information on vocational choice, club memberships, types of science sets owned and desired, maga-

[1] Delivered before *The National Association of Biology Teachers*, Philadelphia, Pa. December 30, 1940.

[2] Fitzpatrick, Frederick L. *Science Interests.* Teachers College, Bureau of Pub., New York, 1936. Contains annotated summary.

[3] Zim, Herbert S. *Science Interests and Activities of Adolescents.* Ethical Culture Schools, New York, 1940.

zines read, pets owned, etc., made it clear that biological interests were often expressed through these chanels. For example, 75% of the students reported owning pets—35% had more than one pet. These pupils reported caring for their pets and many had taught the pet to do tricks, etc. Most desired additional pets and wanted information about them. Specific interest in animal breeding, health and care often appeared.

In another phase of the study nine exhibits were carefully prepared. These were shown to 1,432 pupils in grades 7 through 10 in controlled situations. It was possible to obtain a record of the time spent by pupils viewing each exhibit. Data were gathered on the exhibits voted most and least interesting and on pupils' questions (written and oral) about the exhibits. The exhibit, "How Life Begins" ranked uniformly first on all grades but 10th. The exhibit contained no material on mammalian reproduction. The exhibit "What Things Are Made Of," dealing with chemical composition of inorganic and organic material, generally ranked second. Another biological exhibit on, "How We Get Energy," illustrating the flow of energy from the sun through plants and animals into human foods, got very low responses, ranking among the lowest of the exhibits. The responses by boys and girls to these exhibits differed: Girls slightly favored the biological exhibits. Exhibit 8, "How Electricity Is Made and Used," ranked second for boys and seventh for girls.

In another phase of the study pupils were allowed to express preference for films (fictitious) in a list. These films, by title and description, were related to the same areas of science as the exhibits which had been previously shown. The replies showed strong interest in *understanding* reproduction and other biological topics. For topics in physical science (chemistry and electricity) there were stronger interests in *construction* and *manipulation* than in understanding.

Further understanding of biological interest was obtained by a study of topics wondered about by students. A list of questions covering a very wide range of science material was made. On it students could indicate the extent they had wondered about these questions. Space was provided for questions to be written in. The data indicated strong sex differences. Of the ten questions which brought the strongest responses from girls, eight were biological. Of the ten highest for boys only three were biological.

Of the questions wondered about exclusively by boys (ranking in the top ten for boys and not for girls) only one out of ten was a biological question ("What were the first living things like?"). Of the questions wondered about exclusively by girls eight out of nine were biological. These questions were related to genetics, psychology, and physiology. 667 pupils wrote in their own questions at the end of the list. Of these questions 37% of the boys' and 51% of the girls' were biological. Practically all were on human and animal biology.

A last source of information came from an analysis of the individual exhibits at the Science and Engineering Fairs of the American Institute over a period of seven years. From the entry blanks reliable data on voluntary science activities were obtained. Of the 1,576 entries studied, on the junior high school level, 29% of the boys and 58% of the girls submitted biological exhibits. On the senior level there was a change to 37% of the boys and 55% of the girls. A detailed consideration and analysis of 506 exhibits showed that 65% of the biological exhibits were in animal and

human biology, 12% were on plant life and the remainder dealt with miscellaneous topics, such as microphotographs, other laboratory techniques and soil conservation.

Space does not permit presentation of the additional data which exists or of more detailed analysis of that so sketchily presented here. In summary, the research led to five conclusions on biological interests of adolescents:

1. Adolescents are interested in themselves and the living things around them.
2. Adolescent biological interests are *specific* and most frequently relate to topics on health, disease, physiology, anatomy, and animal life.
3. Boys and girls show distinct differences in their interests and activities in biology.
4. These interests are "permanent," *i.e.*, they exist for long enough periods to be of educational significance.
5. These interests slowly change with the age of the group so that the strong preference and sex differences of young adolescents tend to disappear as they grow older.

The significance of these interests must be considered in the light of two subsidiary questions: "to whom" and "for what." First, what is the significance of these interests to the adolescent? The adolescent is that person who frequently appears both in biology classes and psychology textbooks. We know that he (or she) is an actively growing person. Besides growth in height and weight, glandular readjustment is taking place. As a result the individual has reached sexual maturity and bodily changes have been produced by both primary and secondary sex characteristics. There may be other results due to glandular unbalance resulting in the conditions so well exploited by a prominent yeast company. This is also a period of basic family readjustment: of new social adjustments to members of the same and opposite sex. New feelings are aroused. There are new concerns, fears, and problems for the adolescent. What is the significance of biological interests for these young people?

For most students, biology is more than just another course to be passed. Passing the course may have its problems, but, at the same time, the adolescent is interested in those phases of the subject which give him information on his own growth and development. The adolescent is concerned with the normalcy of his changing body and of his own behavior. Information in the biology course may give him the needed reassurance or, in some cases, may promote fears and maladjustment. Biology is significant in that it *can* provide information on problems of growth, on the family and on race. It may significantly aid the adolescent to understand problems of sexual behavior. In giving these understandings, attitudes and standards will also be conveyed. In short, many of the biological interests of adolescents are significant in terms of the immediate personal and social problems of these young people. The intellectual type of interest is more limited or finds its roots in these problems.

For the pupils who are "interested" in biology, who spend their spare time in the school laboratory, or who have laboratories of their own at home, there may be a further significance to their interest. These interests, which are closely connected with vocational choices, frequently exhibit strong psychological drives. The pupil may be seeking to escape from some pressing home or personal situation. His interest may be closely associated with a parent, a friend, or hero. Another may be intellectualiz-

ing a personal problem through such activities as dissection, breeding rats, etc. For these pupils, special guidance is needed to determine the significance of their biological interests and their educational and vocational possibilities.

Because biological interests are significant for the adolescent, they are also significant for the teacher. At least the teacher becomes aware of those phases of biology most appropriate for adolescents. The use made of this in the curriculum must, of course, vary with each school. Furthermore, these interests are significant in understanding the individual and his problems. Occasionally, they may clarify a situation of maladjustment. More frequently they call attention to the *normal* problems of *normal* students and show the ways that a school subject can really become functional for a pupil. These interests are significant in pointing a way for the teacher to broaden the interests of his pupils. While the adolescent is usually interested in *specific* things, the teacher may, while providing ways to answer these specific problems, show their relationship to the broader principles of biology. Thus the principles of evolution and genetics acquire a different significance when approached through the human problems of students than through the study of fossils or sweet peas.

Consideration of the biological interests of adolescents and the needs and problems disclosed by these interests makes it pertinent to raise a number of questions on the teaching of biology. Should the subject be taught in 9th or 10th grades when the strongest interests are expressed in 7th and 8th grades? Should instruction in biology be limited to a course or two in the upper grades when throughout his high school career the student is constantly faced with problems, which biological information can help him to solve? Are biology teachers evading a responsibility when they show little concern with the nature and methods by which biology is presented in general science courses, courses in domestic science, etc.? Should taxonomy and classification be eliminated from biology courses or should we consider (among other things) at what grade level the interests of pupils would make such data appropriate? Many other fundamental questions come to mind which cannot be ignored because of the unique significance that the study of biology has for adolescents in our peculiar culture.

Lastly, in considering the significance of these interests, we should ask "Significant for what?" These interests have little value if they are only used to superficially enliven a traditional course in the subject. Even if the teacher attempts to answer the specific questions of adolescents these interests are not being well utilized. There is need of a direction in using biological interests in the curriculum. Such direction has been suggested[4,5] it is to use these interests as a means of meeting the needs and problems of the individual. Through doing this the students' growth may be so promoted that there will be a fuller realization of his potentialities. This, in turn, should increase the students' effective participation in our democratic society —a participation which is essential if democracy is to continue. In terms of such direction, the rôle of the biology teacher becomes a more vital one than it has ever been before.

[4] Comm. on Secondary School Curriculum. *Science in General Education.* D. Appleton-Century Co., New York, 1938.

[5] Powers, Samuel R. "The Improvement of Science Teaching." *Teachers College Record,* January, 1939.

A Plea for Taxonomy in High School Biology

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The summary of a relatively recent questionnaire[1] in which teachers were asked to list the academic subjects which they considered "essential for effective teaching of biology in the secondary schools" places Taxonomy *twelfth* in order of importance. A cursory examination of popular textbooks in the field of biology indicates that many authors, too, relegate Taxonomy to one of the last places. Students, of course, as a consequence of teacher-attitudes and textbook neglect also tend to manifest little interest in the problem of Species and Classification. They will usually rank Classification twelfth or even lower in order of interest and importance among other popular biological topics.

But is Classification uninteresting and unimportant? Should it hold twelfth place with high school biology teachers and biology students? When the fact is considered that more than eighty per cent of our high school students will not have an opportunity to continue their education in college, and that a certain part of that fortunate twenty per cent who do continue with college work will not select natural science, much less Taxonomy, either as a field of major interest or as an elective course, the question arises as to whether sufficient time and attention is given to Classification in the high school biology sequence.

There is no doubt that other phases of biological training are of relatively greater value to the individual than exhaustive drilling in the principles of Classification, and that the former do contribute more to fuller living. An appreciation of biological principles and sanctions, for example; a proper respect for the all-important kingdom of bacteria; a correct evaluation of the health that is the heritage of youth; and a love of nature and nature study will broaden vistas and present opportunity.

But the results that flow from the dynamic presentation of taxonomic methods are not to be underrated. Taxonomy serves to develop in the student an appreciation and comprehension of the order and law inherent in Mother Nature. A deep respect will well in his heart for the genius that has enabled the scientist to pigeonhole hundreds of thousands of animals and plants, accurately and systematically, on the basis of their own individual characteristics, bestowing upon these same plants and animals permanent scientific names which are recognized and used throughout the known world. The student of Taxonomy is bound to grasp some idea of community relationships and of organic designs that exist in the world of living things. He commences to appreciate the organic-pattern that lives in and upon the soil, and is ready to study the rules of classification which have brought order out of chaos.

Now since there is the possibility that tangible good will accrue from the proper presentation and study of Taxonomy, why are so many high school

[1] Riddle, Dr. Oscar. "Preliminary Impressions and Facts from a Questionnaire on Secondary School Biology." *American Biology Teacher*, Vol. 3, No. 5, p. 151.

teachers and high school students undisguisedly indifferent to the topic? Why, in defiance of the fact that for the remainder of their lives they must meet scientific names in semi-scientific and scientific periodicals and in museums and zoological garden, do students eschew them at present? Several reasons are at hand which seem to answer the interrogation.

First, there is the limitation that must be experienced by the biology teacher who has not had personal or special training in Taxonomy. Doctor Riddle, in the article previously quoted, rightly deplores the fact that 47 per cent of the teaching group who are presenting a complicated science (Biology) to students of our secondary schools do not have "special preparation" for teaching that science. And it is very probable that a goodly portion of the 53 per cent of teachers who do have "special preparation" as teachers of biology possess very few credits in Taxonomy.

Taxonomy, being a fairly complicated science, will be difficult for the average high school student. He will find the terminology heavy and the intricacies of the rules perplexing unless the teacher can make this "hard topic" easy. When the teacher does not present taxonomic data in an attractive way, the student votes against Taxonomy. It is tagged a "dry old subject, loaded with dozens of big names." And is it probable that a teacher who has not had a special course in Taxonomy can simplify this topic for his or her students?

Second, there is paucity of knowledge on the part of the high school student. He frequently has a poor English vocabulary and a meager scientific background. He has had no Latin. Of course Latin is a dead language and Professor Pope,[2] although he dares to raise a "voice in the wilderness" in its behalf, finally resigns himself to the softness of our times. He knows that most adolescents will not subject themselves to the discipline of a course in elementary Latin, and that there is no parental voice heard in our land which will insist upon the substitution of a "solid" for a "fad" when Junior or Mary want the "fad."

Yet, how much less floundering would occur, in the "meaningless bog of Latin and Greek scientific terms" that must be encountered sooner or later, if high school students had just one year of Latin. How much easier it would be to instill an appreciation of the Binomial System of Nomenclature and the rules of Taxonomy.

Third, there are the limitations that characterize some text-books. Several of the newer biologies have clear and interesting presentations of the topic of Classification. There seems to be little reason why students who are using such texts should not become interested in the topic, quickly master fundamental principles, and make practical applications—granted, of course, that the teacher is not an inhibiting factor. Other texts, however, devote little space to the subject of Taxonomy, and the few data that are presented are bone-dry. The topic is more or less isolated in the text and is introduced so late in the course that students are deprived of numerous opportunities in which they could make practical application had they mastered a few of the interesting taxonomic rules. This prevents them from enjoying the justifiable satisfaction that accrues to those who have conquered a difficult situation, and may even lessen their enthusiasm for learning in general.

When poor texts are used the burden of presenting the topic of Classification in an interesting manner falls upon the shoulders of the "prepared" teacher.

[2] Pope, Philip H. "Biology and the Classics." *American Biology Teacher*, Vol. 3, No. 3, p. 87.

He must devise his own method of approach or adapt one that is presented in some other text. A story-method is usually popular with high school students. Whatever the method adopted, the idea of species and the need that exists for an orderly arrangement of known species of animals and plants should be explained; artificial and natural methods of classification, contrasted; and finally, the Binomial System of Nomenclature, together with the simple rules that govern the system, should be clarified.

Copies of the "International Rules of Zoological Nomenclature" may be obtained from the United States Department of Entomology and Plant Quarantine, Washington, D. C., for the nominal sum of $0.50. They are very helpful in formulating simple, reliable taxonomic rules for the high school student. The following set is used by the author in teaching principles of Taxonomy:

1. All scientific names must be in accord with international rules of nomenclature.
2. There are two names for each species, a generic and a specific name.
3. They are Latin, or Latinized, or treated as such.
4. The generic name, a single word, begins with a capital letter and is treated as a noun.
5. The specific name is written with a small initial letter by zoologists and is considered as an adjective or a substantive.
6. The name of a family of animals ends in *idae;* that of a plant ends in *aceae.*
7. If the author who first described the organism is to be cited, his name follows the specific name in different type.
8. An abbreviation, as ***P. domesticus,*** may be substituted for ***Passer domesticus*** when the scientific name is repeated in a paragraph.

Winter and Life

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Our purpose in organizing a unit on winter adaptations of plants and animals was to keep biology a science of *living* things. We felt that with the falling of leaves and the freezing of the stream, our courses generally became more and more lifeless. Although crayfish, tadpoles, and native fishes were still swimming in the aquaria, and our white rats continued reproducing, and plants on the window sill were thriving, biology became more a study of charts, models, and pictures than of life.

Introduction to the unit came naturally one day late in autumn when the classes were discussing the question of what happens to various animals when winter comes. Such a question leads quickly to a rather startling idea: *All species of living things survive the winter.* The only exception, of course, would be the possible extinction of some isolated species.

A simple bit of reasoning, but it opens the way to many pertinent biological questions. The problem underlying our winter unit, then, was to discover how living things adapt themselves to the conditions of winter.

Because most of the reference material was not available in quantities, another unit involving use of the text was carried on simultaneously. This arrangement afforded the pupils time to make investigations and prepare reports which were the chief part of the unit. Two pupils worked together, investigating some local winter habitat, and then reported their findings to the class. Here are the habitats that were studied:

Inside rotting logs.
Under shaggy bark of trees.

(*Continued on page 118*)

President's Page

Not long ago a biology teacher, when asked his philosophy of teaching, said this, "Take the student where you find him, do all you can for him, and when he leaves you, follow him so you may better judge the effectiveness of your teaching."

That would mean that teaching is not a nine to four job, but a real profession demanding twenty-four hours of the day. We expect a doctor to give up his own time to save a life and yet often we are not willing to give of our time to save the mind that goes with that life. Our teaching cannot go on the high professional level that we want it until we are willing to put every ounce of our effort into the game. Then, and then only, can we demand and get the equipment and the money we need for the job.

There is a great deal more in that philosophy than would appear on the surface. Generally we assume that we must take the student where we find him educationally, but in the smaller community it is indeed a wise high school teacher who in one way or another connects the elementary grades to his work. In this way he prepares his students before he actually contacts them. But now that we have the student, how are we going to do all that we can for him? To the full time biology teacher the answer would be to have the subject matter so well in mind that the student may have all of the attention. And the really "big" teacher can always find the time to turn a sympathetic ear to troubles, even if they come before nine or after four. And when a group of teachers get together socially, what is wrong with talking shop if that helps to do the best we can for the student? What surer common grounds for conversation could there be?

It must also be kept in mind in this philosophy that the student's ability and interests play an important part in doing all we can for him. We cannot expect each student to be vitally interested in every phase of biology and we cannot expect to reach each student by the same method. Therefore, we must do the very things we ask our students to do, observe, draw conclusions, and then do something about it. If you are one who tells the students that they are living the best and happiest part of their life right now, then you are not sold on the idea of teaching. Every moment we live should increase our interest in living and if teaching is a drudgery and not an inspiring piece of work you could be doing your best for the student by changing your methods—or your occupation.

With the great numbers of students that most teachers have it is impossible to keep in touch with all of them after they have left the classroom. This does not mean that we should close our eyes to the future of our students. A doctor uses each case as an experience to guide him in future treatments, so, then, should we use each pupil. According to this philosophy we are not really teaching until we have followed a great many of them in what they do after they leave our class. If we do that, we will have spent our twenty-four-hour day in teaching.

Homer A. Stephens.

INTRODUCING YOUR NEW EDITOR

Beginning with the February issue of THE AMERICAN BIOLOGY TEACHER the name of John Breukelman will appear on the staff page under the caption *Editor-in-Chief*. Dr. Breukelman has been Professor of Biology at Emporia State Teachers College, Emporia, Kansas, since 1929. He was born in South Dakota and received his undergraduate instruction in that state. For several years he taught in high schools in South Dakota. At Iowa he earned a master's degree and a Ph.D. in zoology.

He has been an active member of *The National Association of Biology Teachers* and has contributed several excellent articles to the Journal; the last one of these, entitled *The Biology of the Stream*, has been accepted for publication in a future issue. During 1941 he served as President of the Kansas Association of Biology Teachers.

The amount of time required of an editor is greater than most persons realize, and it was because the press of other duties made it difficult for me to devote the time to the job that the position warrants that I have asked to be relieved. In turning over the files to Dr. Breukelman I do so with every confidence that his training, his experience, his interests, and his enthusiasm will insure the continued improvement of your Journal. I trust that each of you will in your own way give him your hearty cooperation and support.

In concluding my duties as editor I extend sincere thanks to all of those—officers of the association, contributors, associate editors, and publishers—who during the past two years have helped in the production of the magazine.

EDWARD C. COLIN

THE SCIENITFIC SPIRIT

In his address as retiring president of the American Association for the Advancement of Science, given at Dallas, Texas, December 29, 1941, and published in full in *Science* for January 2, 1942. Dr. Albert F. Blakeslee said many things of interest to the biology teacher. We recommend a reading of the entire address. Here is a sample which constitutes a challenge to all of us:

"How can science best be fostered? I need offer only a few suggestions.

"Science in common with all intellectual pursuits needs tolerance, freedom from restraint and a recognition of the value of individuality. Men differ widely in their capacities for research. A great need therefore in the advancement of science, as of other intellectual endeavors, is to devise means for discovering the exceptional abilities at an early age and giving such abilities exceptional opportunities in order that their span of effective service with its social values may be prolonged.

"The public, whom science serves, knows all too little what science really means. The magic and gadgetry of scientific applications rather than the methods and ideals of science make the great appeal. And yet the ideals and methods would help society reach judgments on the basis of ascertained facts rather than through emotional appeal and personal profit and would transform our daily lives if universally applied. Think what a change would come if our representatives in legislative halls should open each session with the prayer of Huxley: 'God give me strength to face a fact though it slay me'—and really mean it."

Winter and Life

(*Continued from page 115*)

Inside galls on various kinds of plants.
Among decaying leaves on the ground.
In the top layer of soil, less than one foot down.
In the lower layer of soil, more than one foot down.
In the mud and debris at the bottom of a pond.
In the mud and debris at the bottom of a river.
On water plants in a pond.
Among the stones in the water of a creek.
On the walls of a cellar or cave.
Among the first-year leaves of mullein and other low plants.
In garages, barns, and other unheated buildings.
In heated buildings.

The report given by each team included a statement of all living things found, including eggs, cocoons, seeds, and other immature forms; an exhibit of all specimens possible; the pupils' observations as to the condition or activities of the specimens; and finally an explanation of how the habitat might aid the species in survival. During their reports some of the pupils displayed insects, seeds, and other small specimens by placing them in Petri dishes and reflecting the image on a screen with an opaque projector. But because of the excessive heat, living animals may be shown in this way for only a short period at a time. Some of the pupils used pictures in the same way to supplement their collections. One of the incidental results of this assignment was the addition of many living specimens to our laboratory. Three species of wild mice, a large colony of ants, and various hibernating beetles and spiders were among the contributions, as well as a good deal of aquarium stock found locally.

Other problems and activities in the unit will be outlined briefly. Some of them were kindly suggested by Dr. Ann Haven Morgan, whose "*Fieldbook of Animals in Winter*" served as a valuable reference guide in this work.

Field Trips for Comparing Temperatures in Various Habitats

Whole classes took part in some of the trips, but for others only two or three boys were sent to obtain data. The records from different class periods and different days provided adequate data for discussion of temperature variation in different habitats.

A comparison of temperatures taken at the same time in air and under snow on a cold day demonstrated the insulating effect of snow crystals. Although our attempt to observe snow crystals under a microscope was not very successful, pictures aided in pointing out how the trapped air spaces retard the transmission of heat.

Boys drilled down with a soil auger and checked the temperature at one, two, and three foot depths in the soil. A comparison of the readings for cold and warm days gave a clue as to why surface insects seek refuge in the soil in winter, and why earthworms migrate downward in the fall.

Similar results were obtained from an investigation of temperatures in various levels of pond water. On February 12 at 9:30 in the morning, for example, the air temperature above the pond was 9.5° centigrade. Just under the ice near shore the water registered 0.5°. And at a depth of two feet it was 3.0°. During the following night a cold wave hit this part of the state, and next day at the same time the air temperature over the pond had dropped to −3.5°. But under the ice there was no observable drop from the previous day.

Charting and discussing these data help pupils understand why some of the

land salamanders seek water for winter cover, and why blue-gills move to deeper water as cold weather approaches. In a study of this habitat three points need emphasis: that since it is in its liquid form, water under the ice is always above the freezing point; that water in winter is not always warmer than the air, nor always colder, but that it is more *uniform;* and that it is more uniform at deeper levels than at the surface.

Readings taken on different sides of trees, on north and south slopes, on wind-swept hills and in protected ravines also provided data for discussion.

Special Reports from Reading or Research

The following topics were studied chiefly as pupil reports, a few as general discussions:

How do the methods of catching fish in the Mississippi River near Keokuk differ in summer and winter? Talk with local fishermen about it.

Migration of birds. What species nest farther north and come here for the winter?

Hibernation.

Winter cover, its importance to animal life, and how man controls cover to aid game birds and mammals.

Comparison of the insulation materials used in the nests of animals with those used by man. (Samples were glued to cardboard and shown with the opaque projector.)

Diets of common winter birds.

Color changes of birds and mammals: goldfinch, ptarmigan, weasel, etc.

Snow and sleet, their composition and formation.

Weather conditions in this vicinity: information from weather bureau on rainfall, frost dates, growing season, etc.

Further Assignment Problems

The information obtained from field trips, reports, and demonstrations provided a background for assignment or discussion of other problems connected with winter survival: Of what protective value is snow to animals wintering in the soil near the surface? Why do quail sometimes tunnel into snow drifts when not feeding? How would a heavy coating of sleet endanger birds that were in the drifts? If snow begins to melt, then freezes into a crust, how might this affect the outcome when a fox is chasing a rabbit? Mice and shrews make their tunnels through the snow and rarely come to the surface; how would snow affect the diets of hawks and owls? Where does snow melt faster—in a woods or on an open field? On a north slope or a south slope? How does the speed of melting affect soil erosion, flood conditions, etc.?

We make no claim that this unit on winter adaptations was in any sense complete or that it was carried out in the best manner. We claim merely that it is worth trying and worth improving.

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Amount and Nature of Biology Teaching in Secondary Schools: Data from a Questionnaire

DR. OSCAR RIDDLE
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The sixth and last segment of a summary of results obtained from a questionnaire returned by teachers of biology in secondary schools is reported in the following pages.[1] The Committee on the Teaching of Biological Science wishes here to acknowledge that this study was made possible by funds granted by Carnegie Corporation of New York to the Union of American Biological Societies. That Corporation is not, however, the author, owner, publisher or proprietor of this publication, and it is not to be understood as approving by virtue of its grant any of the statements made or views expressed therein. Also to *The American Biology Teacher* the Committee is indebted for very promptly bringing the several parts of this report to the attention of a large group of high school teachers.

The items considered in the following pages are of much immediate concern to teachers of high school biology; they are also matters of concern to all others engaged either in education or in any aspect of biological work; indeed, some items would appear to touch the interest of the informed citizen. Although no more than 3,186 teachers have reported on any item it is nevertheless true that all states and practically all types of communities within nearly all states are represented in these reports. The trends and conditions now attending biology teaching and the biology teacher are thus perhaps indicated with fair accuracy by data which biology teachers themselves have provided.

[1] The several parts of this report have been published during 1941 by *The American Biology Teacher*. The six segments have already been bound as a single document which may be obtained without charge from Dr. David F. Miller, Biology Building, Ohio State University, Columbus, Ohio.

The Sciences in the High School Curriculum

Amount of biological science offered in schools. For the school in which they were teaching the teachers were asked to indicate the various biological and other science subjects offered, together with the number of semesters included in each course. Adequate data for biological science in 4-year schools were supplied by 2,175 teachers in public, 80 in parochial and 149 in private schools. Elsewhere these teachers had noted the amount of general science (and senior science) taught and the "percentage" of biology in such courses. It was thus possible to calculate the total offering of the schools thus reported in terms of 60-minute hours per week, per year. The results for all such public schools are given in Table 1. Many schools in the South are organized on the 7 + 4 year plan, and in these cases the 8th year was of course treated as a part of the high school.

Additional information was requested which would have supplied information concerning a much more significant mat-

ter, namely, the average (and perhaps the maximum) amount of biological instruction received or receivable by a pupil in the school thus reported. Unfortunately this latter information was supplied too infrequently to warrant consideration in this report. Only the total "offering" of biological subject matter—in the form of an *average* for schools of the various states and for communities of various sizes within each state—is available for examination. Although the data obtained for many entire states are very inadequate, and for sub-divisions of states this inadequacy is multiplied, it seems possible to observe significant trends and differences between states, between various geographical regions, and perhaps between some more restricted areas.

For the country as a whole it seems clear that most biology is "offered" in cities of more than 100,000. For the 12 large cities separately summarized (Table 1) a mean (not school average) of 9.6 hrs. is found, and for all schools in other cities of more than 100,000 an average of 10.1 hrs. The average for schools of small cities is 8.0 hrs., for towns, 6.8 hrs. and for rural schools 6.5 hrs. Thus there would appear to be a correlation between the population of the community and the amount of biological science offered in its schools. Since large cities usually offer most biology it seems remarkable that the few schools reported from Milwaukee (5.7 hrs.), Boston (6.6 hrs.) and St. Louis (7.2 hrs.) appear to offer less biology than does the average school of the entire state in which these cities are located. New York City now offers definitely less biology (7.0 $\pm$ hrs.) than the tabulation indicates, because a marked curtailment of offerings occurred within 1 to 2 months after more than half the data from that city were secured.

In many schools part or much of the biological science offered is of course elective; or indeed elective for students pursuing certain courses (college preparatory, agriculture) and not available to those enrolled in still other courses (commercial, technical). It therefore does not necessarily follow that the average graduate from a school which "offers" 10 hrs. of this science receives more biological instruction than does the average graduate of a school which "offers" only 5 hrs. of biological science. Again, the "offering" of some large technical or trade schools is remarkably little. For example, an Industrial High School in New York City, enrolling 4,000 girls, offers only 0.82 hr. of biology—*i.e.*, a one-year course in general science (3.3 hrs. per week) which is 25% biology.

From New York state outside of New York City 136 replies were received. From 3 of these schools the report was "no biology taught," and 17 others (all apparently 4-year schools) are reported to offer less than 2 hrs. of biological science.

The geographical region which seems to offer least biology in its public schools is New England (6.7 hrs.). Next follow, in order of increase, the Southern (6.9 hrs.), Middle Atlantic (7.0 hrs.), Central (7.2 hrs.) and Western (9.1 hrs.) states. The individual states with indicated lowest offerings in biology are Vermont (4.2 hrs.), Rhode Island (5.1 hrs.), upstate New York (5.2 hrs.) and Maine (5.7 hrs.); those offering most are Utah (12.1 hrs.), California (10.3 hrs.), Missouri (10.2 hrs.) and Idaho (10.0 hrs.).

On the basis of the samples obtained 149 teachers in private schools say their schools offer slightly more hours (7.6) of biological science, and 80 teachers in parochial schools report definitely fewer hours (6.0) of biology than is reported

TABLE 1

Average total hours per week (and year) of biological science offered in public high schools, and the number of replies on which this average is based

State, city or region	Total		Excluding large city		Other large cities		Small cities		Towns		Rural	
	Hrs.	Replies										
Connecticut	6.7	23	......	......	8.7	8	5.8	8	4.9	5	7.5	2
Maine	5.7	13	......	......	......	......	8.8	1	5.6	5	5.2	7
Massachusetts	7.3	60	7.4	55	6.5	9	9.1	27	5.0	16	6.8	3
Boston	6.6	5	......	......	......	......	......	......	......	......	......	......
New Hampshire	7.0	15	......	......	......	......	7.8	7	6.5	5	5.6	3
Rhode Island	5.1	5	4.6	4	......	......	4.4	3	......	......	5.0	1
Providence	7.4	1	......	......	......	......	......	......	......	......	......	......
Vermont	4.2	7	......	......	......	......	4.8	1	......	......	4.1	6
NEW ENGLAND	6.7	123	6.7	117	7.6	17	8.0	47	5.3	31	5.4	22
Delaware	8.3	1	......	......	8.3	1	......	......	......	......	......	......
Maryland	7.8	18	......	......	......	......	11.25	2	6.9	10	8.0	6
Baltimore	......	......	......	......	......	......	......	......	......	......	......	......
New Jersey	6.9	54	......	......	9.9	13	5.5	18	6.2	21	7.6	2
New York	6.4	163	5.2	88	6.5	7	4.3	26	5.5	28	4.7	27
New York City	7.9	75	......	......	......	......	......	......	......	......	......	......
Pennsylvania	7.6	175	7.5	169	9.3	14	8.7	36	7.3	76	6.4	43
Philadelphia	9.5	6	......	......	......	......	......	......	......	......	......	......
Virginia*	6.7	40	......	......	8.3	3	5.5	6	8.0	10	6.2	21
West Virginia	6.5	47	......	......	......	......	5.7	6	6.4	21	6.9	20
Wash., D. C.	16.5	1	......	......	......	......	......	......	......	......	......	......
MID. ATLANTIC	7.0	499	6.9	417	8.9	38	6.5	94	6.8	166	6.2	119
Alabama	6.6	31	......	......	7.0	7	4.8	3	6.8	8	6.6	13
Arkansas	6.9	6	......	......	......	......	......	......	5.8	4	9.0	2
Florida*	7.7	11	......	......	10.0	1	......	......	7.6	4	6.3	6
Georgia*	6.2	9	......	......	7.0	2	6.4	2	5.5	1	6.0	4
Louisiana*	7.6	8	7.2	7	......	......	6.3	2	7.7	2	7.5	3
New Orleans	10.4	1	......	......	......	......	......	......	......	......	......	......
Mississippi	6.3	9	......	......	......	......	......	......	3.9	2	7.0	7
No. Carolina*	6.9	54	......	......	6.5	1	7.1	11	7.3	17	6.7	25
Oklahoma	7.1	69	......	......	12.0	3	8.4	6	7.0	20	6.6	40
So. Carolina*	6.6	8	......	......	......	......	8.5	2	6.0	3	6.0	3
Tennessee	6.3	19	......	......	5.1	1	7.8	1	6.0	5	6.4	12
Texas*	7.5	47	......	......	11.0	4	11.3	5	6.7	24	6.7	14
SOUTHERN	6.9	271	7.0	270	8.7	19	7.8	32	6.8	90	6.7	129
Illinois	7.8	211	7.2	171	5.8	7	10.0	30	7.3	51	6.3	83
Chicago	10.5	40	......	......	......	......	......	......	......	......	......	......
Indiana	8.0	110	......	......	11.9	17	8.6	25	6.7	27	7.0	41
Iowa	7.2	51	......	......	8.5	1	7.9	9	9.6	11	6.3	30
Kansas	8.3	61	......	......	12.1	5	9.3	9	8.4	10	7.5	37
Kentucky	8.2	19	......	......	......	......	7.2	3	7.2	9	9.9	7
Michigan	6.4	104	6.2	94	7.2	5	7.0	27	5.7	28	5.7	34
Detroit	8.4	10	......	......	......	......	......	......	......	......	......	......
Minnesota	6.5	74	6.3	70	7.5	5	6.3	8	6.3	16	6.1	41
Minneapolis	10.4	4	......	......	......	......	......	......	......	......	......	......
Missouri	10.2	52	10.6	46	18.8	12	7.0	4	7.2	10	8.1	20
St. Louis	7.2	6	......	......	......	......	......	......	......	......	......	......
Nebraska	5.9	37	......	......	......	......	8.7	2	6.2	10	5.5	25
North Dakota	6.4	21	......	......	......	......	6.9	2	5.5	2	6.4	17
Ohio	6.4	158	......	......	7.9	33	6.2	22	6.2	36	7.1	67
South Dakota	6.6	24	......	......	......	......	8.1	4	5.6	4	6.4	16
Wisconsin	5.9	90	5.9	84	7.5	1	6.8	30	5.2	31	5.5	22
Milwaukee	5.7	6	......	......	......	......	......	......	......	......	......	......
CENTRAL	7.2	1,012	7.0	946	10.0	86	7.8	175	6.7	245	6.4	440

TABLE 1—(*Continued*)

State, city or region	Total		Excluding large city		Other large cities		Small cities		Towns		Rural	
	Hrs.	Replies										
Arizona	9.5	8	......	......	......	......	......	......	9.4	6	10.4	2
California	10.3	116	......	......	15.3	26	8.5	31	8.4	29	6.3	30
Colorado	6.9	24	......	......	9.4	4	5.3	2	7.3	10	5.7	8
Idaho	10.0	13	......	......	......	......	15.8	2	11.1	3	8.1	8
Montana	6.5	17	......	......	......	......	6.5	2	6.0	4	6.6	11
Nevada	8.8	2	......	......	......	......	......	......	8.8	2	......	......
New Mexico	7.3	7	......	......	......	......	......	......	6.3	3	8.1	4
Oregon	7.4	25	......	......	6.8	6	8.2	3	6.7	6	8.0	10
Utah	12.1	9	......	......	13.5	2	13.0	3	15.0	1	9.6	3
Washington	9.5	39	8.7	34	12.3	2	11.4	5	8.6	8	7.6	19
Seattle	14.8	5	......	......	......	......	......	......	......	......	......	......
Wyoming	6.5	10	......	......	......	......	......	......	5.6	4	6.4	6
WESTERN	9.1	270	9.1	265	13.2	40	11.3	48	8.1	76	7.1	101
TOTAL U. S.	7.3	2,175	7.2	2,015	10.1	200	8.0	396	6.8	608	6.5	811

by 2,175 teachers in public schools (7.3 hrs.).

Physics and chemistry in the curriculum. Teachers were asked to supply information concerning the amount of physics and chemistry "offered" in their schools. The replies of only 2,787 of the 2,903 public school teachers returning questionnaires are at all helpful in indicating the place of physics in these schools. Of these teachers 15.3% indicate either that physics is not taught or are arbitrarily included in this group by reason of their failure to check the item "as taught." Only 2,079 teachers give in full the number of hours of physics offered, but the average offering in all geographical regions and in communities of all sizes is close to 5.0 hrs. This value is exclusive of physics included in courses in general science.

The replies of only 2,701 of the 2,903 public school teachers returning questionnaires assist in indicating the place of chemistry in these schools. Of these teachers 16.2% indicate either that chemistry is not taught or are thus classified arbitrarily because of failure to check the item "as taught." Only 2,000 teachers supply the number of hours of chemistry offered, and—as in the case of physics—this offering is notably close to 5.0 hrs. in nearly all regions, states and communities. Chemistry taught in general science is not included in this average.

If the content of the general science course be ignored, it is clear that physics and chemistry are somewhat less generally offered in this sample of public schools than is one or another biological subject. It is also obvious that the number of hours devoted to physics and chemistry is more standardized and much less variable than is the time devoted to biological science. Though the summaries made for offerings in physics and chemistry are not tabulated here, they have already been supplied (by O. Riddle) in the form of typed copies to committees especially interested in the place of those sciences in secondary education.

(*To be continued*)

Biological Briefs

Brown, Bruce. *Sulfanilamide for Trachoma.* Hygeia 19: 608–609; 642. August, 1941.

The dreaded eye disease, trachoma, is endemic over half the earth's surface and now has reached epidemic proportions. Movements of troops and refugees have greatly increased its spread through Europe and Asia Minor. Physicians estimate that one-third of the population of China and 98% of Egypt's population are infected. In the United States, trachoma has claimed 70,000 victims, half of whom have been Indians. It has recently been identified as a virus disease, spread usually by towels and crowded living conditions, but occasionally by wind and dust. In its acute stages it causes ulceration of the cornea and blindness. Formerly, treatment for trachoma resulted in scars on the eye tissue which had to be periodically removed by surgery. The sulfanilamide treatment arrests serious cases within two weeks, and cures in six months without scarring.

Young, Stanley P. *The Return of the Musk Oxen.* American Forests 47: 368–372. August, 1941.

The reëstablishment of the musk oxen in Alaska after an absence of over 100 years furnishes a dramatic chapter in the annals of big game conservation. In 1930, a herd of 34 animals captured in Greenland were transported by boat, barge, and railway to Fairbanks. Released on Nunivak Island, it now numbers more than 60, and will in time increase so as to permit restocking other areas in Alaska. The musk ox is one of the most hardy of all mammals. It breeds at four years, and the gestation period is eight months. The single calf is born in April or early May, and the family subsists on sedges and shrubs of the Arctic valleys. After the early snows, dwarf willows and other herbaceous plants are obtained by pawing through the snow. The animals held their own against the Arctic wolf and primitive man, but the advent of whalers and modern firearms caused their near extinction in much of their former domain.

Randolph, L. F. *An Evaluation of Induced Polyploidy as a Method of Breeding Crop Plants.* American Naturalist 75: 347–363. July–August, 1941.

There is considerable recent controversy as to the value of polyploidy (doubling in chromosome number) induced by colchicine treatment and other techniques in the production of new species and giant varieties of horticultural and crop plants. At present, methods are available for inducing polyploidy in almost any plant species. It would be inaccurate to assume that all plants would be thus improved; many of our cultivated species, such as the potato, are already polyploids, and further chromosome duplication would be detrimental. Although some tetraploid forms exhibit gigantism, many are merely sturdier and more robust; most, however, do show larger reproductive parts. Increased seed size is of importance; however, in many plants a reduction in fertility varying from 5% to almost complete sterility compensates for this. Fertility in those strains may be increased by selective breeding. Profound physiological and chemical changes in polyploids may be of value, also. Differences in osmotic pressure influence resistance to frost; increases in vitamin content and of many other essential food elements have been noted. In certain crops, an increase in alkaloids or other harmful substances would be detrimental. Inbred tetraploids should maintain their vigor without the need of introducing hybrid stock for longer periods than normal diploid plants.

Ruth Sherman Stein

CHICAGO BIOLOGY ROUND TABLE

At the regular meeting of the Chicago Biology Round Table, December 12, 1941, Dr. Lee F. Yeager, State Forester, gave a timely talk on "Renewable Resources of Illinois." He emphasized the waterfowl research program of the Illinois Natural History Survey, and by means of colorful moving pictures let his audience see the staff at work and share with them some of their interesting experiences. He also mentioned a number of the Survey Publications that are of especial interest to Biology Teachers.

The Program for January 16, 1942, will be "What Biology Can Do for Preparedness."

At the February meeting, Lorin T. Wood will speak about "Fishes of Illinois."

It was decided to cooperate with the Central Association of Science and Mathematics Teachers in 1942.

Books

BENEDICT, RALPH C., KNOX, WARREN W., STONE, GEORGE K. *High School Biology.* The Macmillan Co., New York. 724 pp. 1938. $1.50.

Literary Style: High School Biology gives a fascinating explanation of the relation between man and man, man and the lower animals, and man and plants, from early times up to the present. Many other interesting biological problems are considered. The language is concise but not lacking in clearness. One is carried forward in much the same manner as he is by the action in a good novel. The material is so presented that students of average ability, as well as the more intellectual ones, will get pleasure from reading the book.

Psychological Soundness: This text effectively promotes continued interest on the part of the pupil by using to great advantage suggestions for the use of live material, by making reference to familiar organisms, and by limiting the number of technical terms. Such terms, when used, are defined simply and are repeated for emphasis.

There are many suggestions for field trip work and for individual research problems.

Mechanical Make-up: The book was subjected to a series of mechanical stress experiments, such as scuffing, cover strength, etc., and in almost all instances stood up very well. There is an attractive blue-green binding that should rank high in durability. The paper is of good quality, and the clear type is very legible under varying conditions of light. The cuts are excellent, not only for their descriptiveness, but also for the skillful manner in which they are set up and labeled. There is a pleasing balance between drawings and halftones. Four beautiful color plates are included. The page size is 8⅜ by 5½ inches. The weight of the book is slightly over two pounds.

Subject Matter: There are forty chapters grouped under nine units headed as follows: Man is one of millions of kinds of living things; There is unity among all living things; Living things and their environment are ever changing; All living things have the same problems; Nutritional relationships establish a balance in nature; Living things relate themselves to their environment; Reproduction is race preservation; Reproduction is the basis of race change; Human progress is a biological phenomenon. Practical applications are well made, especially in the section on heredity, and social implications are stressed. No essential topics have been omitted.

In general the subject matter seems accurate, with only such minor slips as are common in first editions of works of this type. An example of a minor error is the statement on page 547 that Mendel worked with peas for eleven years: in his report Mendel mentions eight years. An error of greater importance occurs on page 569 where in a discussion of radish-cabbage hybrids it is stated that the progeny of such hybrids are either straight cabbage or straight radish. According to Dobzhansky in his recent book, *Genetics and the Origin of Species,* the second generation hybrids are tetraploids with distinctive characters entitling them to be classed as a new synthetic species.

Learning Exercises and Teacher Aids: The review and thought questions at the ends of chapters are good, but the directions lack definiteness. Very few simple experiments are listed. The introductory pages to all large units set up most stimulating simple questions such as, "Who knows where you can get a zoo with more animals in it than there are in the biggest circus?" or "Do you know about the factories that use sun power?" or "Do you know how many ancestors you have?" The frequent use of the phrase "make a list" tends to reduce valuable activities to routine chores. Such vague statements as "construct a railroad," "investigate this in your neighborhood," might be improved. A few fully directed activities are preferable to many without complete directions. As a whole this book will give students a good start in the direction of learning biology.

ALAN A. NATHANS (Chairman)
LLOYD L. T. CARMICHAL, Canada
L. LIEBERMAN, New York
E. PORTER, Connecticut
D. R. APPLETON, Vermont

CULBERTSON, JAMES T. *Immunity Against Animal Parasites.* Columbia University Press, New York. x + 274 pp. 1941. $3.50.

The author of this book had in mind two classes of readers, those who were already familiar with the subjects of parasitology and immunology but were not versed in immunity to animal parasites, and persons of more experience who desire a review of the recent literature.

The first part of the book deals with natural resistance and acquired immunity, the second and largest part is on immunity in specific diseases. Under the latter head appear chapters on amoebiases, leishmaniases,

trypanosomiases, malarias, coccidioses, trematodiases, cestodiases, nematodiases, and response to arthropods. Part three is devoted to applied immunology, including classification of parasites, vaccination, and diagnosis of parasitic infection.

The book is filled with facts, briefly stated and backed by citations to original authors. Theoretical discussion is kept at a minimum. There is an author-subject index of 18 pages; four illustrations; and two tables. As a handbook and guide to the recent literature *Immunity Against Animal Parasites* should prove especially valuable to the biologist.

E.C.C.

EBERSON, FREDERICK. *The Microbe's Challenge.* The Jaques Cattell Press, Lancaster, Pa. viii + 354 pp. 1941. $3.50.

The Microbe's Challenge is a dynamic presentataion of man's efforts to maintain himself in a universe of microbes. The discussion of the past history of each pathogen depicts the persistent, careful procedures and observations of those men who have led the fight as well as the changes which the microorganisms have made in their struggle for existence.

For those who wish a clear, interesting picture of the high lights of preventive medicine this book is invaluable. What has been done and who did it, our present knowledge of the pathogens, and certain clear indications of what must and will be accomplished in the near future are treated in a most readable style. This book will prove inspiring and instructive for both layman and teacher.

Though the subject is quite technical, the presentation is not burdened with terminology. Words peculiar to the subject are accompanied by short explanations in the text, and a fuller treatment of them is found in the short glossary.

BROTHER H. CHARLES

CORRINGTON, JULIAN D. *Working with the Microscope.* McGraw-Hill Book Co., New York. xi + 418 pp. 1941. $3.50.

This book was written to fill the gap between existing juvenile or popular works on microscopy and the numerous technical and professional manuals on the subject. The author has had wide experience in this field. He is editor of Microscope Department of *Nature Magazine* and organizer and permanent secretary of the American Society of Amateur Microscopists.

There are 17 chapters and three appendices. The topics considered are: the microscope, temporary mounts, simple balsam mounts, procedures in microtechnique, processed balsam mounts, cell mounts, stained whole mounts, smear preparations, bacteria, microscopic skeletons, grinding hard objects, sectioning, the newer techniques, special preparations, preparation and use of reagents, sources of supplies, literature on microtechnique, and reference tables.

The various chapters make a graded series of exercises, beginning with the simpler techniques and proceeding to the more difficult methods of mounting materials for observation under the microscope. The author has in mind the amateur working alone as well as classes, clubs, and other groups having the advantage of an experienced leader.

There are many excellent illustrations, including drawings, halftones, and photomicrographs. There is a complete index. The book should prove widely useful among high school teachers because of its many practical suggestions and the clear and readable descriptions.

E. C. C.

NEEDHAM, JAMES G. *About Ourselves: A Survey of Human Nature from the Zoological Viewpoint.* The Jaques Cattell Press, Lancaster, Pa. xi + 276 pp. 1941. $3.00.

The plan and the purpose of this interesting book are best expressed in the author's own words:

"I have endeavored to assemble and to present in simple untechnical form some of the basic zoological facts that must be taken into account in any penetrating study into the nature of human kind.

"Bound as we are to all animal life by ties of tissue and cell and organ, by bonds of breathing and of feeling; bound to the higher ranges of that life by blood and bone and brain, by nurture, first in a mother's womb and then in a mother's arms, it would be very stupid of us to ignore the meaning of our zoological heritage, and so miss the beginnings of the story that it tells of the coming into dominance of mind and the gathering together of the first materials for a social order.

"The ultimate concern of biology is with that part of human life wherein emotions mix with rationality, contributing when the mixture is good to our welfare and happiness; when bad, to our confusion and disillusionment.

"This book is an exposition of human nature, without any plan for its improvement. The lack of such plans is due to my fear that Mother Nature would not be very regardful of them; that she will go right along making our successors after her regular patterns, and that they will continue to behave very much as we have done."

The first half of the book consists of ten chapters on "Man in his Biological Aspects";

the second half also is divided into ten chapters, under the general heading, "Society in Its Biological Aspects."

Young and old alike will enjoy reading it. It is not too difficult for the superior high school student. The mature biologist will welcome it as the expression of the wisdom and the philosophy of a sincere man who has spent a lifetime in the study of animal life.

E. C. C.

SCHMIDT, KARL P. and DAVIS D. DWIGHT. *Field Book of Snakes of the United States and Canada.* With four colored plates and 103 drawings by Albert A. Enzenbacher and 82 photographs from life. G. P. Putnam's Sons, New York. xiii + 365 pp. 1941. $3.50.

This is the latest member of the series of excellent field books published by Putnam. In its preparation the authors had at their disposal the extensive facilities of the Field Museum of Natural History in Chicago where both are members of the staff. It differs from other recent handbooks on snakes in its greater emphasis on life histories, habits, behavior, and ecology.

The book is divided into two parts, an Introduction (77 pages) and a Systematic Account of the Snakes of the United States and Canada (274 pages). The first part in particular makes very interesting reading: the topics discussed are the place of snakes in nature, folklore of snakes, history of the study of snakes in the United States, definition and classification, external characters and coloration, the poison apparatus and treatment of snake bite, habits and behavior, and collection, preservation, and the study of snakes.

The second part opens with a discussion of means of identification and the use of a key; this is followed by a key to the genera of the snakes in the United States and Canada. The territory covered is rich in its snake fauna: of the eighteen families of snakes in the world seven are represented in North America north of Mexico. The greater part of the book is devoted to a description of the species in these seven families. Frequent use of drawings and the inclusion of keys to the species in the larger genera make identification relatively easy. Data on range, size, food, and breeding habits are given.

For those who are interested in snakes—and that seems to include a large number of people—this book answers in a very clear and satisfying manner most of the questions. Its light weight and pocket size fit it especially for field trips.

E. C. C.

AUDIO-VISUAL EDUCATION

Copies of the *Proceedings* of the Fifth Annual Southern Conference on Audio-Visual Education, which was held in Atlanta on November 13–15, 1941, are available for purchase at $1.00 each. Included in the *Proceedings* are the principal addresses given at the Conference, and complete stenographic transcripts of seven group forums which were conducted during the Conference by leading audio-visual educators. Orders and remittances should be sent to the Southern Conference on Audio-Visual Education, 223 Walton Street, N. W., Atlanta, Georgia. Postage is free on all orders which are accompanied by remittances.

MULTIPLE EFFECTS OF THE NON-AGOUTI GENE IN RATS

The simple Mendelian gene for non-agouti (unticked hair) not only makes the coat of the Norway rat solid black, but it also reduces brain weight about 17%, and both savageness and wildness to about zero, in addition to other changes both morphological and behavioristic, as shown by Keeler and King, 1941 (Anat. Rec. 81: 48–49).

Nearly all tame albino rats in America are tame not because of the presence of albinism, but because they carry latently the black (non-agouti) gene, the coat-color manifestations of which are masked by albinism.

Thus, if one crosses almost any naturally tame albino rat with a wild gray Norway rat, members of the first hybrid generation are very wild and so are the Grays of the second hybrid generation, but the solid black-colored animals appearing in the second hybrid generation in four such crosses observed by me have all been very tame by nature. Any black-hooded rats will also be tame, but possibly not quite so tame as the solid color blacks.

However, it is not difficult to find persons who doubt my findings, probably because of environmental differences in their setup.

I know that this cross of tame albino to Wild Gray Norway is frequently made in High Schools to demonstrate Mendelian segregation of coat-color characters, and hence possibly a hundred or more readers of the *American Biology Teacher* have actually made this same cross or will be making it this winter.

I would appreciate it very much if those teachers who have already made this cross would write me their findings with regard to the tameness of black animals appearing in the second hybrid generation following the cross.

To those who are making the cross this winter, I would suggest that the black rats be segregated from the rest when of weaning age, because wild members of a family may wreck the normal, peaceful tendencies in any rat. I would appreciate a report on the tameness of these segregated blacks.

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